Technical note | Modbus protocol available
WXT530

Modbus RTU protocol available for WXT530

> **i** Modbus RTU is available for Vaisala Weather Transmitter WXT530 Series from firmware version 3.80 onwards.

Ordering new WXT530 with Modbus

If you want to order a new WXT530 with the Modbus option, use the order code WXT53X**U**XXXXXXXXXXX. The highlighted character (U) defines the needed protocol: RS-485, Modbus RTU, client, 19200 baud, 8, E, 1.

To use Modbus with an existing WXT530, see Using Modbus with old WXT530 (page 10).

WXT530 default Modbus settings

> **i** CLI is the command line interface, such as ASCII, NMEA and SDI-12.
> Vaisala Configuration Tool works only in the CLI mode. To use Vaisala Configuration Tool, change from Modbus mode to CLI mode first. See Changing from Modbus mode to CLI mode (page 9).

When you order WXT530 with Modbus, the default settings are the following:

Setting	WXT530 default value CLI mode	WXT530 default value Modbus mode
Baud	19200, N, 8, 1	19200, E, 8, 1
Address	0	1

> 💡 You can change WXT530 Modbus address by typing the new address to the holding register number 10 (0x0009).

To use the Modbus protocol:

- Make sure the firmware is 3.80, or newer. If not, update the firmware. See Updating WXT530 firmware (page 9).
- Change from the CLI mode to the Modbus mode. See Changing from CLI mode to Modbus mode (page 9).

Register maps

> **i** To avoid errors in transmission, Vaisala recommends implementing the retry functionality for Modbus master software. If the sensor does not respond to the first Modbus query command, the same query is sent again.

WXT530 has a non-isolated RS-485 serial line as a Modbus interface. WXT530 uses 2 Modbus register ranges:

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- [Holding registers (configuration and function)](#)
- [Input registers (device status and measurement values)](#)

You can read the holding registers and both read and write in the input registers.

You can control device functionality and configuration in Modbus holding registers.

Register range	Function
1 - 10	Device status
11 - 31	Commonly used unit system independent values
32 - 51	Measurement values in metric units
52 - 71	Measurement values in imperial units
72 - 112	Other measurement values

The register values are expressed as 16-bit integers with the use of suitable scaling factors (SF), if needed. The measurement values are multiplied with a scaling factor and mapped to the 16-bit registers as an integer. The register value ranges are:

- 0 … 65530 for unsigned (U) values. 65535 indicates an invalid or unavailable value.
- -32762 … 32762 for signed (S) values. 32767 indicates an invalid or unavailable value.

Holding registers (configuration and function)

Table 1   Holding registers

Reg. No.	Address	Function	De-fault	Value range Min.	Value range Max.	Unit	SF [1]	S/U [2]	Reg. range Reg. min.	Reg. range Reg. max.
1	0x0000	Altitude	0	-100	5000	m	1	S	-100	5000
2	0x0001	Wind direction deviation angle	0	-359.9	359.9	°	10	S	-3599	3599
3	0x0002	Averaging interval, T, RH, X, A, Tdw	10	1	10	min	1	U	1	10
4	0x0003	Averaging interval, air pressure	10	1	10	min	1	U	1	10
5	0x0004	Averaging interval, wind	1	1	10	min	1	U	1	10
6	0x0005	Averaging interval, solar radiation	10	1	10	min	1	U	1	10
7	0x0006	Heating control	1	0, 1 or 3 = Heating on 2 = Heating off				U	0	3
8	0x0007	Reset rain accumulation counter		Write value 0x3247 => Precipitation counter reset						
9	0x0008	Reset device		Write value 0x3247 => Device reset						

| Reg. No. | Address | Function | Value range | | | | | | Reg. range | |
			De-fault	Min.	Max.	Unit	SF [1]	S/U [2]	Reg. min.	Reg. max.
10	0x0009	Modbus address	1					U	1	247
11	0x000A	CLI mode	Write value 0x0F => Switch into CLI mode							

1) *Scaling factor*
2) *Signed / Unsigned*

Input registers (device status and measurement values)

Table 2   Device status

| Reg. No. | Address | Function | Register values | | | |
			High byte		Low byte	
1	0x0000	Device identification	WXT530 model	WXT531: 01 WXT532: 02 WXT533: 03 WXT534: 04 WXT535: 05 WXT536: 06	SW version	Value = the last digits of the SW version number
2	0x0001	Reserved				
3	0x0002	Measurement parameters according to different WXT530 model	Temperature	00 = Available 07 = Not available	Dewpoint	00 = Available 07 = Not available
4	0x0003		Relative humidity		Absolute humidity	
5	0x0004		Mixing ratio		Air pressure	
6	0x0005		Wind		Rain	
7	0x0006	External sensors at analog inputs	Solar radiation sensor	00 = Connected 07 = Not connected	Level sensor	00 = Connected 07 = Not connected
8	0x0007		Temperature sensor		Rain gauge	

Table 3   Commonly used unit system independent values

| Reg. No. | Address | Quantity | | Measurement range | | | | | Reg. range | | |
				Min.	Max.	Unit	SF [1]	S/U [2]	Reg. min.	Reg. max.	Error value
11	0x000A	Relative humidity	Instant	0.0	100.0	% RH	10	S	0	1000	32767
12	0x000B		Min.								
13	0x000C		Max.								
14	0x000D		Average								

Measurement range								Reg. range			
Reg. No.	Address	Quantity		Min.	Max.	Unit	SF 1)	S/U 2)	Reg. min.	Reg. max.	Error value
15	0x000E	Relative air pressure	Instant	300	1200	hPa	10	S	3000	12000	32767
16	0x000F		Min.								
17	0x0010		Max.								
18	0x0011		Average								
19	0x0012	Wind direction	Instant	0.0	359.9	°	10	S	0	3599	32767
20	0x0013		Min.								
21	0x0014		Max.								
22	0x0015		Average								
23	0x0016		Raw								
24	0x0017	Reserved									
25	0x0018	Reserved									
26	0x0019	Precipitation type 3)	Instant	0	90		1	S	0	90	32767
27	0x001A	Wind measurement quality	Instant	0	100	%	1	U	0	100	65535
28	0x001B	Global radiation	Instant	0.0	2000.0	W/m^2	10	S	0	20000	32767
29	0x001C		Min.								
30	0x001D		Max.								
31	0x001E		Average								

1) *Scaling factor*
2) *Signed / Unsigned*
3) *Precipitation Type, register No. 26*

    0 = No Precipitation

    40 = Precipitation

    90 = Hail

Table 4   Measurement values in metric units (°C, m/s, mm, mm/h)

Measurement range								Reg. range			
Reg. No.	Address	Quantity		Min.	Max.	Unit	SF 1)	S/U 2)	Reg. min.	Reg. max.	Error value
32	0x001F	Air temperature	Instant	-50.0	60.0	°C	10	S	-500	600	32767
33	0x0020		Min.								
34	0x0021		Max.								
35	0x0022		Average								

Reg. No.	Address	Quantity		Min.	Max.	Unit	SF [1]	S/U [2]	Reg. min.	Reg. max.	Error value
		Measurement range							**Reg. range**		
36	0x0023	Dew point	Instant	-50.0	60.0	°C	10	S	-500	600	32767
37	0x0024		Min.								
38	0x0025		Max.								
39	0x0026		Average								
40	0x0027	Wind chill temperature	Instant	-60.0	70.0	°C	10	S	-600	700	32767
41	0x0028	Reserved									
42	0x0029	Heater temperature	Instant	-50.0	150.0	°C	10	S	-500	1500	32767
43	0x002A	Wind speed	Instant	0.0	75.0	m/s	10	S	0	750	32767
44	0x002B		Min.								
45	0x002C		Max.								
46	0x002D		Average								
47	0x002E	Reserved									
48	0x002F	Wind speed	Raw	0.0	75.0	m/s	10	S	0	750	32767
49	0x0030	Precipitation accumulation (absolute) [3]	Instant	0.00	655.30	mm	100	U	0	65530	65535
50	0x0031	Precipitation accumulation (differential) [4]	Instant	0.00	100.00	mm	100	U	0	10000	65535
51	0x0032	Precipitation intensity	Instant	0.00	200.00	mm/h	100	U	0	20000	65535

1) *Scaling factor*
2) *Signed / Unsigned*
3) *Continuous accumulated value*
4) *Accumulated value between 2 consecutive requests*

Table 5   Measurement values in imperial units (°F, mph, in, in/h)

		Measurement range						Reg. range			
Reg No.	Address	Quantity		Min.	Max.	Unit	SF [1]	S/U [2]	Reg. min.	Reg. max.	Error value
52	0x0033	Air temperature	Instant	-58.0	140.0	°F	10	S	-580	1400	32767
53	0x0034		Min.								
54	0x0035		Max.								
55	0x0036		Average								
56	0x0037	Dew point	Instant	-58.0	140.0	°F	10	S	-580	1400	32767
57	0x0038		Min.								
58	0x0039		Max.								
59	0x003A		Average								
60	0x003B	Wind chill temperature	Instant	-76.0	158.0	°F	10	S	-760	1580	32767
61	0x003C	Reserved									
62	0x003D	Heater temperature	Instant	-58.0	302.0	°F	10	S	-580	3020	32767
63	0x003E	Wind speed	Instant	0.0	167.8	mph	10	S	0	1678	32767
64	0x003F		Min.								
65	0x0040		Max.								
66	0x0041		Average								
67	0x0042	Reserved									
68	0x0043	Wind speed	Raw	0.0	167.8	mph	10	S	0	1678	32767
69	0x0044	Precipitation accumulation (absolute) [3]	Instant	0.000	25.800	in	1000	U	0	25800	65535
70	0x0045	Precipitation accumulation (differential) [4]	Instant	0.000	3.9370	in	10000	U	0	39370	65535
71	0x0046	Precipitation intensity	Instant	0.000	6.5530	in/h	10000	U	0	65530	65535

1)   *Scaling factor*
2)   *Signed / Unsigned*
3)   *Continuous accumulated value*
4)   *Accumulated value between 2 consecutive requests*

Table 6   Other measurement values

Reg No.	Address	Quantity		Min.	Max.	Unit	SF [1]	S/U [2]	Reg. min.	Reg. max.	Error value
		Measurement range						**Reg. range**			
72	0x0047	Absolute humidity	Instant	0.0	1000.0	g/m^3	10	S	0	10000	32767
73	0x0048		Min.								
74	0x0049		Max.								
75	0x004A		Average								
76	0x004B	Mixing ratio	Instant	0.0	1000.0	g/kg	10	S	0	10000	32767
77	0x004C		Min.								
78	0x004D		Max.								
79	0x004E		Average								
80	0x004F	Abs. air pressure	Instant	300	1200	hPa	10	S	3000	12000	32767
81	0x0050		Min.								
82	0x0051		Max.								
83	0x0052		Average								
84	0x0053	Wind speed	Instant	0.0	270.0	km/h	10	S	0	2700	32767
85	0x0054		Min.								
86	0x0055		Max.								
87	0x0056		Average								
88	0x0057	Reserved									
89	0x0058	Wind speed	Instant	0.0	145.8	knots	10	S	0	1458	32767
90	0x0059		Min.								
91	0x005A		Max.								
92	0x005B		Average								
93	0x005C	Reserved									
94	0x005D	Wind speed	Raw	0.0	270.0	km/h	10	S	0	2700	32767
95	0x005E	Wind speed	Raw	0.0	145.8	knots	10	S	0	1458	32767
96	0x005F	Reserved									
97	0x0060	Reserved									
98	0x0061	Reserved									
99	0x0062	Wet bulb temp	Instant	-50.0	60.0	°C	10	S	-500	600	32767
100	0x0063	Wet bulb temp	Instant	-58.0	140.0	°F	10	S	-580	1400	32767

		Measurement range							Reg. range		
Reg No.	Address	Quantity		Min.	Max.	Unit	SF [1]	S/U [2]	Reg. min.	Reg. max.	Error value
101	0x0064	Specific enthalpy	Instant	-100.0	1000.0	kJ/kg	10	S	-1000	10000	32767
102	0x0065	Air density	Instant	0.0	3.0	kg/m^3	1000	S	0	3000	32767
103	0x0066	Reserved									
104	0x0067	Reserved									
105	0x0068	Reserved									
106	0x0069	Reserved									
107	0x006A	Reserved									
108	0x006B	External temperature	Instant	-40	80	°C	10	S	-400	800	32767
109	0x006C	External temperature	Instant	-40	176	°F	10	S	-400	1760	32767
110	0x006D	Wind measurement quality	Raw	0	100	%	1	U	0	100	65535
111	0x006E	Reserved									
112	0x006F	Reserved									

1)   *Scaling factor*
2)   *Signed / Unsigned*

Updating WXT530 firmware

> ℹ️ WXT530 must be in the CLI mode before the firmware update. Firmware update is not possible in the Modbus mode.

▶ 1. Connect WXT530 service cable to the USB port of your computer and to WXT530 service connector.
   2. To make sure that WXT530 is in the CLI mode, open the terminal software, such as TeraTerm, with settings 19200, 8, N, 1 and type the command **?!**.
      If the sensor is in the CLI mode, the terminal program prints the sensor address.

> 💡 Alternatively, open Vaisala Configuration Tool. If you can communicate with it, WXT530 is in the CLI mode. If not, see Changing from Modbus mode to CLI mode (page 9)

   3. Start *WxtLoader.exe*.
   4. To change the serial port settings, select **Configuration**.
      • Select the COM port in use.
      • Select serial port settings: 19200, 8 bit, none, 1 bit.
   5. When **Status** is **Connected to device**, select **Upload**.
      When **Upload Status** is 100 %, the firmware update is completed.

To change to the Modbus mode, see Changing from CLI mode to Modbus mode (page 9). When WXT530 starts up in Modbus mode, communication with the terminal software is no longer possible.

Changing from CLI mode to Modbus mode

Before changing to the Modbus mode, save the settings with Vaisala Configuration Tool.

▶ 1. Set the computer terminal software, such as Tera Term, communication parameters to **19200 8N1**.
   2. Connect WXT530 service cable to the USB port of your computer and to WXT530 service connector.
   3. In the terminal software, type the command **?XU,M=M!**.

WXT530 starts up in the Modbus mode. Communication with the terminal software is no longer possible.

Changing from Modbus mode to CLI mode

> ℹ️ When you change from the CLI mode (ASCII, NMEA, SDI-12) to the Modbus mode, or the other way round, also the accumulated values are reset. The parameter ranges in the CLI mode are sometimes bigger than what is allowed in the Modbus mode. WXT530 enforces the narrower range when the device is turned to the Modbus mode.

▶ 1. Set the computer terminal software (such as Tera Term) communication parameters to **19200 8N1**.
   2. Press **SPACE** and keep it pressed down.
   3. Connect WXT530 service cable to USB port of your computer.
   4. Release **SPACE** and press it down again. Keep the it pressed down for 5 seconds. WXT530 starts in the CLI mode.

> Alternatively, you can change from the Modbus mode to the CLI mode by typing the value `0x0F` to register number 11 (0x000A).

Using Modbus with old WXT530

If you already have WXT530, you need an RS-485 connection to use the Modbus protocol. You can change the communication parameters with the Vaisala Configuration Tool software, or, by using WXT530 command line with a terminal software.

> ⚠ **CAUTION!** When you update to Modbus, WXT530 settings roll back to default settings. You can save WXT530 settings with Vaisala Configuration Tool.

To use the Modbus protocol:

- Make sure the firmware is 3.80, or newer. If not, update the firmware.
  See Updating WXT530 firmware (page 9).
- Change from the CLI mode to the Modbus mode
  See Changing from CLI mode to Modbus mode (page 9).

If you want to return from the Modbus mode to the CLI mode, see Changing from Modbus mode to CLI mode (page 9).